APPENDIX A

THE 60-TON FLOATING CRANE

The 60-ton floating cranes still in use lift and move loads associated with general marine work and within their rated capacity. This crane (Design 413D) is not self-sustaining and must be towed to its work site. It is classified as a Category C-2 vessel and has an authorized strength of 11 personnel. The operator's cab, engine, hoist, and swing machinery are all part of the machinery house.

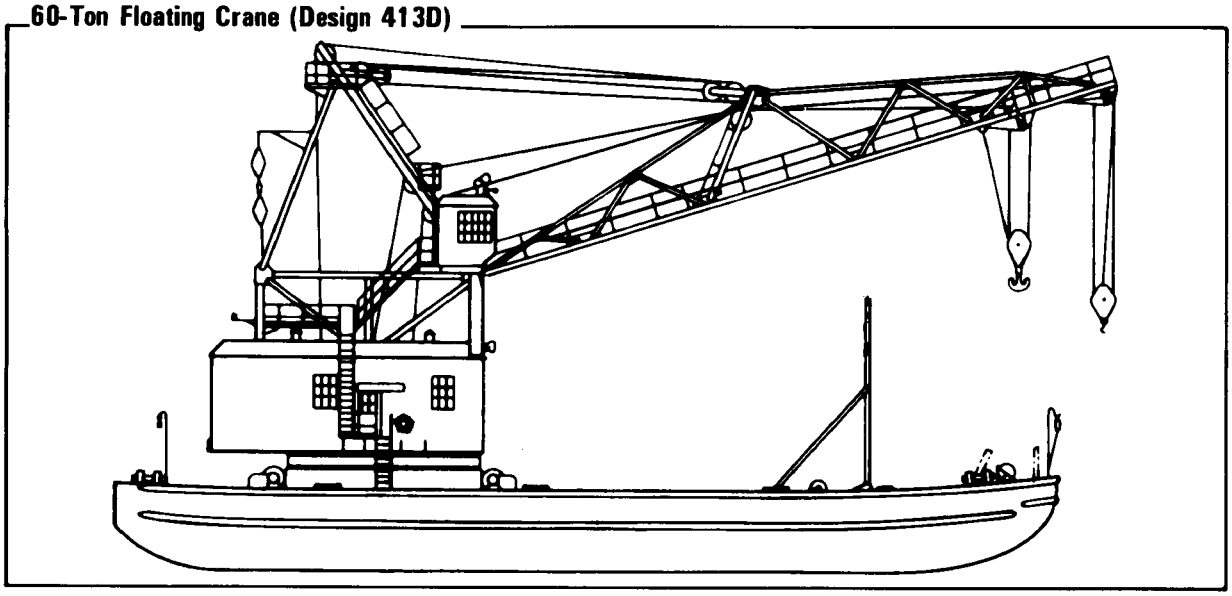
A DC power system provides all power aboard the 60-ton crane. For information on maintenance, troubleshooting, and reeving the hoist and lift blocks, refer to Chapters 9 and 10.

SPECIFICATIONS

The various pieces of barge and crane equipment have been designed, selected, and installed to provide well-coordinated pieces of operating machinery to comply with specified requirements. Safety devices and guards have been built into or about the equipment to protect both the crane and crane operating personnel.

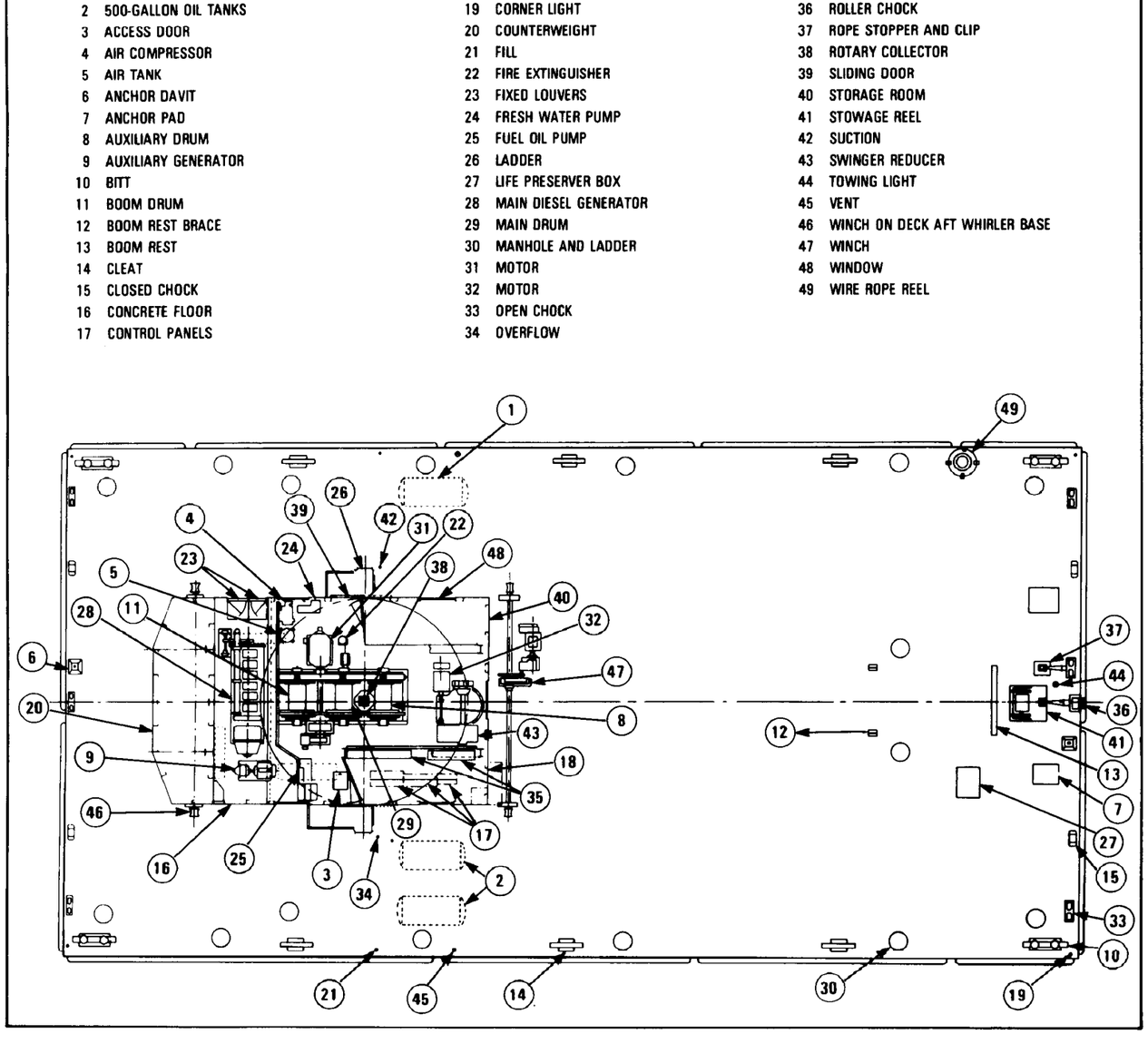
The revolving crane on this unit has a lift capacity of 60 LTONs (2,240 pounds) with a maximum radius of 73 feet. The crane is powered by a diesel-electric generator set. The diesel engine, nominally rated at 250 BHP at 600 RPMs and coupled to a 150-kilowatt, DC generator, supplies electrical energy to the hoist motor, swinger motor, and other equipment. The machinery house and operator's cab are fully enclosed and contain the crane machinery, power units, control panels, auxiliary pumps, and operator's controls. The housing rests cm a steel beam platform that forms the rotating crane base. The entire crane rotates on double-flange steel rollers turning on circular steel tracks around a center steadiment. An auxiliary generator set, consisting of a diesel engine coupled to a DC generator, supplies auxiliary power to operate the air compressor, fuel oil pump, freshwater pump, and other equipment. This unit is also used to provide auxiliary power for lighting, pumps, and other equipment when the main power unit is not in operation. This crane is suitable for loading and unloading heavy lifts of cargo and is mounted on a nonpropelled barge. The following illustrations show the 60-ton floating crane. The table on page A-3 gives its specifications.

60-Ton Floating Crane (Design 413D)



Top View of 60-Ton Floating Crane (Design 413D)

1 500-GALLON FRESH WATER TANKS
2 500-GALLON OIL TANKS
3 ACCESS DOOR
4 AIR COMPRESSOR
5 AIR TANK
6 ANCHOR DAVIT
7 ANCHOR PAD
8 AUXILIARY DRUM
9 AUXILIARY GENERATOR
10 BITT
11 BOOM DRUM
12 BOOM REST BRACE
13 BOOM REST
14 CLEAT
15 CLOSED CHOCK
16 CONCRETE FLOOR
17 CONTROL PANELS
18 CONTROL ROOM
19 CORNER LIGHT
20 COUNTERWEIGHT
21 FILL
22 FIRE EXTINGUISHER
23 FIXED LOUVERS
24 FRESH WATER PUMP
25 FUEL OIL PUMP
26 LADDER
27 LIFE PRESERVER BOX
28 MAIN DIESEL GENERATOR
29 MAIN DRUM
30 MANHOLE AND LADDER
31 MOTOR
32 MOTOR
33 OPEN CHOCK
34 OVERFLOW
35 RESISTORS
36 ROLLER CHOCK
37 ROPE STOPPER AND CLIP
38 ROTARY COLLECTOR
39 SLIDING DOOR
40 STORAGE ROOM
41 STOWAGE REEL
42 SUCTION
43 SWINGER REDUCER
44 TOWING LIGHT
45 VENT
46 WINCH ON DECK AFT WHIRLER BASE
47 WINCH
48 WINDOW
49 WIRE ROPE REEL



60-Ton Floating Crane (Design 413D)

BARGE DATA

Length, overall (molded) .....142 ft
Beam (molded) .....58 ft
Depth, overall (midship) .....12 ft
Draft (mean light) .....3 ft 5 in
Draft (with ballast and load) ....5 ft 1 in

CRANE DATA

Capacity, main hook .....60 LTONs @ 73-ft radius
Capacity, whip hook .....15 LTONs @ 100-ft radius
Hook speed, main hook .....22 1/2 FPM
Hook speed, whip hook .....60 FPM
Operating radius, main hook ....42 ft 6 in to 73 ft
Operating range .....360°
Rotating speed .....0.4 RPM

EQUIPMENT LAYOUT

MACHINERY HOUSE

The machinery house contains the engine equipment and forms an integral part of the rotating structure of the crane. It houses the main power plant, auxiliary power plant, air compressor, freshwater and fuel oil pumps, fire-extinguishing systems, hoist and rotate machinery, associated control panels, and resistor banks for all of this equipment. Refer to the illustration at left.

Main power plant

The crane has one heavy-duty, industrial diesel engine of the solid-injection, cold-starting type. This engine provides power to drive the main DC generators. The engine is a 4-cycle, 6-cylinder, vertical type. The main power plant consists of one 2-wire or 3-wire, 150-kilowatt, 240- or 120/240-VDC generator which is directly driven by a diesel engine. This unit is radiator-cooled and air-started. The fuel pressure is controlled at either the engine or the operator's cab as required. An adjustable, louvered opening in the side of the machinery house provides proper air circulation to the radiator.

Auxiliary power plant

The auxiliary power plant consists of one 2-wire or one 3-wire, 240- or 120/240-VDC generator driven by either a 2-, 3-, or 4-cylinder diesel engine. This unit is battery-started and radiator-cooled. It furnishes power for the operation of the air compressor, fuel oil and freshwater pumps, and all other equipment that must be in operation before initial starting of the main diesel engine.

Main power distribution panel

The main power distribution panel (switchboard), controller panel, and resistor banks for the hoist and rotate machinery are located on the starboard side of the machinery house in separate switchroom enclosures. The main panel board consists of three panel sections. The left panel, when facing the front of the board, is for protector and generator control. The center panel is for hoist control, and the right panel for rotate (slue) control. The power supply to all electrical equipment on the crane is distributed from the right panel, either directly to the equipment or through the lighting panel or rotary collector.

Air compressor

A two-stage, air-cooled air compressor supplies compressed air to the main air receiver for starting the main diesel generator set or sets, for operating the hoist air clutches, and for general service. The compressor is loadless starting and V-belt driven by a 3- or 5-HP, 240-VDC motor. It is usually automatically controlled by an associated pressure switch.

Transfer pumps

The fuel oil transfer pump (cast-iron fitted) is on the starboard side of the machinery house, and the freshwater pump (bronze-fitted) is on the port side. These pumps supply fuel oil and fresh water from the hull fuel oil and freshwater tanks to the respective service tanks mounted in the machinery house, Each pump is driven by a 3/4-HP, 240-HP, 240-VDC motor and controlled by a magnetic starter.

Fire-fighting system

A 50-pound CO_2 cylinder with 50 feet of hose and a discharge nozzle is installed in the machinery house on the portside of the hoisting machinery. This extinguisher protects the crane equipment and the personnel operating in the machinery house area. The system is installed ready for use and will be kept in proper operating condition at all times.

WARNING: Operation of the fire-fighting system while personnel are in the engine room could result in injury or death to personnel. Some type of warning must be established to warn personnel that carbon dioxide (CO^2) is discharging.

Two 15-pound $C0_2$ portable fire extinguishers are mounted in accessible parts of the machinery house. The pm-table bilge and ballast pump, normally stowed on deck, may be used as a fire pump fro-fighting fires, either on board or adjacent to the crane. Fire axes and fire buckets are mounted in accessible places for fighting fires.

Hoist machinery

The hoist machinery consists of a 3-drum, gear-driven, air-clutch-actuated hoist unit, powered by a 135-HP, 240-VDC motor.

Each of the hoisting drums on the crane is equipped with an individual driving gear, manually controlled air clutch, pawl, and mechanical brake. An electric brake is fitted to an extension of the drive motor pinion shaft. Power is transmitted from the motor through the pinion shaft to the hoist reducer gear, which turns the driving gears for both the boom hoist and the main hoist drum. The main hoist drum gear engages directly with the auxiliary hoist drum gear. Each hoist drum is driven by engagement with the driving mechanism through its air clutch and, when not so engaged, is secured by its pawl and mechanical brake. The pawls engage with a ratchet built into each drum. The controls for each drum's clutch, pawl, and mechanical brake are located in the operator's cab.

The hoist motor is controlled through a magnetic controller and resistors in the switch panel room and operated by a master switch in the operator's cab.

The hoist electric brake is a magnetic-type shoe brake that operates with the controller. The brake is arranged for magnetic release when the coil is energized. The brake is automatically set by spring tension when the hoist master switch is in the neutral (OFF) position or power to the motor is interrupted. The brake operating coil is series-wound and is connected in series with the hoist motor.

Two electric air interlock switches, a boom travel limit switch, and two hoist block limit switches are installed as safety devices in the operations of the hoist machinery.

Rotate machinery

The rotate machinery, located at the forward end of the machinery house, provides a rotating movement of the crane upon its base. The crane is rotated when a rotate pinion engages the circular fixed rack on the crane base. The rotate pinion is driven through bevel gearing by a 45-HP, 240-VDC motor.

Power is transmitted from the motor to the driven pinion through a gear reducer and a set of bevel gears. The rotate motor is controlled by a magnetic controller and resistors. It is operated by a master switch in the operator's cab.

One brake is provided with the rotate machinery unit. It is an electrically operated hydraulic brake, equipped with parking and power failure brake controls. The function of the brake is to stop rotate motion and also to hold the rotate platform in a parked position.

WARNING: Do not apply the brake during a power failure if the crane is rotating and a load is on the hook. Sudden brake application would cause the load to swing in an uncontrolled manner, endangering personnel, crane, and cargo.

Center steadiment and rotary collector

The rotary collector is mounted on the center steadiment of the crane and housed in a steel, rectangular enclosure located forward of the main hoist drum. The center steadiment contains the kingpin which helps to maintain the rotating structure in position on the crane base. The rotary collector provides a continuous means of transmitting power from the generator in the machinery house to the various electrical equipment on deck during either a stationary or rotating period of crane operation. The collector consists of a shaft with nine collector rings, one of which is a spare, mounted on a common shaft. This shaft is fixed with the crane base against rotation with the crane, but is flexibly mounted to absorb small deflections. The rings are connected directly to cables leading to the deck equipment. Carbon brushes contact these rings to transmit power supplied from the main switch panel.

Miscellaneous equipment

The *main lighting panel* is located on the starboard side of the machinery house and distributes 120 VDC to the various light receptacles and signal systems in and about the machinery house. The lighting panel also distributes 240 VDC to the fuel oil and freshwater pumps and heater in the operator's cab. The panel is fitted with eight circuit breakers of suitable amperage and voltage capacity for the respective circuits.

A 120-volt DC *engine alarm system* is installed in the machinery house to warn of high water temperatures or low lubricating oil pressures within the main diesel engines. The system is connected to the lighting panel circuit and consists of a warning horn, signal light, and single-pole disconnect switch. In the event of engine trouble, the horn and light operate simultaneously to warn the operator to secure the engine immediately until adjustments or repairs can be made.

An *electric bell* is mounted on the main panel board and sounds when the 120/240-VDC circuit of either the main or auxiliary engine becomes unbalanced beyond safe operation. The engineer is thus immediately warned to correct or adjust the electrical circuits.

A *rotate warning bell* is located under the rotate platform at the forward starboard corner. It is set to operate automatically only when the electric controls for rotation are engaged.

A *trolley* for a 3- to 6-ton hoist is provided for mounting on any one of the several trolley beams installed in the machinery house or the forward engine room.

The location of the various controls is shown in the illustration on page A-9.

OPERATOR'S CAB

The operational controls in the operator's cab of the 60-ton crane are: the hoist master switch, air clutch control valves, hoist pawl levers, boom hoist hand-brake lever, hoist foot-brake pedals, rotate master switch, rotate brake pedal, rotate brake parking push button, emergency stop push button breaker-reset push button, diesel engine fuel pressure control, and electric governor. In addition to the controls, the cab includes a horn for the operator to give warning when moving loads or to otherwise signal for attention during crane operation. A signal bell is included to signal the machinery house, and a floodlight is installed for night operation. List indicators, a portable lantern, cab heaters, cab blowers, and a windshield wiper are installed for the operator's use and comfort.

DECK

Hull deck equipment for the 60-ton crane is discussed as follows.

Deck winches

Two winches are installed—one forward and one aft of the machinery house base. The two winches are utility winches, identical in construction and power. Each is fitted with two winch heads that turn on a common line shaft and may be used for single- or double-load operation within the rated capacities of the units. Manila hawsers and warping lines are supplied with the barge for use with these winches. The drive machinery for each winch

consists of a 10-HP, 240-VDC motor directly driving a speed reducer unit that, in turn, operates the spur gear mounted on the winch shaft. An automatically operated magnetic brake is mounted on an extension of the motor shaft. The control equipment for each winch consists of a drum controller, protective panel, and resistor bank. This equipment is mounted within steel housings, located on the deck just forward or aft of the fore and aft winches respectively. These deck winch units operate only on power supplied from the main generator.

Portable bilge and ballast pump

A skid-mounted portable bilge and ballast pump, complete with lifting frame and operating controller, is normally stowed on deck forward of the machinery house (see the following illustration). This unit serves as either a bilge or ballast pump for emptying or filling the vessel's ballast and void compartments. A portable electric cable and hose for use with the unit are suplied with the vessel. The pump is a centrifugal unit, directly driven by a 7 1/2-HP, 240-VDC motor. The operating controllers are the marine-type starters with an overload protection. This pumping unit also operates on power supplied from the main generator.

Anchor-handling equipment

A hand-operated anchor windlass, located forward, and a cable reel, located midships, are used in handling the forward 750- and 500-pound anchors. The functions of these units are associated with the operation of the forward anchor davit and deck winch. A second 500-pound anchor and anchor davit are installed on the aft deck of the crane and are associated in operation with the aft winch. Canvas covers are provided for both the anchor hoist and the cable reel.

Boom cradle

The cradle, installed on deck just forward of midships, is used for storing the boom when the crane is inactive. This cradle is mounted on pin connections and can be collapsed on deck or completely removed if required. Holes are provided in both the cradle and the boom for securing the boom to the cradle during long periods of shutdown.

Watertight electrical receptacles

Two receptacles are mounted on the crane base, one each on the port and starboard sides of the machinery house. These receptacles are connected to a 120-VDC circuit from the machinery house lighting panel and are intended for general service use about the crane deck. A watertight plug normally will be stowed in the machinery house for use with these receptacles.

MISCELLANEOUS EQUIPMENT

The crew should be acquainted with the nature and existence of the miscellaneous crane equipment. This equipment includes the radio interference suppression equipment, navigation lights, deck equipment, pm-table lights, and floodlights. All other items or portable equipment aboard the crane are listed in the stowage list, a copy of which should be stowed in the machinery house technical data locker. Portable equipment not in use will be stowed in the location described in the stowage list so as to be available at all times.

Several of the motors, generators, and other miscellaneous electrical equipment are fitted with various sizes and styles of electrical capacitors. This is done to prevent static interference with radio reception aboard the crane.

Several oil-burning types of navigation lights with supporting standards or mountings are installed on the cranes: one anchor, four corner, two towing, three dredging, one port, and one starboard. These units will be kept filled with a good grade of kerosene at all times and will be stowed securely to prevent damage when not in use. A navigation yardarm assembly is installed on the aft end of the A-frame, complete with halyard, pulleys, and associated fittings.

Four 120-VDC, 100-watt, hand-portable lights, complete with 100 feet of cable, are furnished for general utility use. These lights are normally stowed in the machinery house storage space. One battery-operated relay hand lantern is bulkhead-mounted in the machinery house near the switchboard, and another near the main engine of the crane. These lights operate in the same manner as the unit installed in the operator's cab, automatically lighting in case the 120-VDC power circuit is interrupted. Each is equipped with a shutoff switch and may be dismounted for portable use.

Four 750-watt, waterproof floodlights are provided for the cranes: one on the machinery house, two on the boom, and one above the operator's cab. The light above the cab can be rotated and elevated from within the cab.

CONTROLS AND INSTRUMENTS

MACHINERY HOUSE

The main controller panel consisting of the controls for the generators, hoist, and rotate motors with protective devises is assembled as a unit. The panel is located on the starboard side of the machinery house in an enclosed control room. The machinery house also contains the lighting panel, engine instrument controls, and miscellaneous switches and push-button signal devices. The crane may be equipped with one or more types Of control panels.

Protective and generator control panel

The controls and instruments located on the control panels are the main and auxiliary circuit breakers, ammeters, voltmeter, main line switch, main generator rheostat, auxiliary generator rheostat, lighting transfer switch, main generator field switch, ground detection lights, and miscellaneous switches and fuses. Although two different types of controllers are used, the same basic functions are performed by each.

The *main circuit breaker* and the *auxiliary circuit breaker* are automatic tripping devices used for overcurrent, undervoltage, and reverse current protection of the main and auxiliary generators. The circuit breakers can be closed by turning the manually operated handle clockwise. Before attempting to start either the main or the auxiliary diesel engine, the respective circuit breakers must be open.

Depending upon the particular model, the panel will be equipped with either one or four *ammeters.* The meters are designed to read output current from either the main or the auxiliary generator. If only one meter is used, a switch allows current to be read from either generator.

One *voltmeter* is used for the control panel. The voltage output of both generators is shown on this meter. The voltage transfer switch is used for switching the meter for voltage output readings from the generators.

The *main line switch* supplies power to the main line contractors. The line switch will be closed only after the main circuit breaker has been closed.

The *main generator rheostat* controls the amount of current supplied to the generator fields, thus controlling the generator voltage output. Before starting the engine, the rheostat will be turned so that maximum resistance is in series with the generator field. After the engine has been started, the rheostat will be rotated according to the arrows and directions on the knob until the desired voltage output is noted on the voltmeter.

The *auxiliary generator rheostat* controls the voltage output from the auxiliary generator in the same manner as described for the main generator rheostat. The *lighting transfer switch* supplies voltage to the lighting panel from either the main or auxiliary generator. The *main generator field switch* completes the circuit to the main generator field and will be left open until the main engine has been started.

Both main and auxiliary generators are provided with red *ground-detection lights.* These lights normally have only one half of the total generator voltage applied to them so that they glow very dimly. When a short circuit occurs on either side of the line, the voltage across one light drops to zero so that full voltage goes across the other, which burns brightly. This indicates aground in the circuit.

The *miscellaneous switches and fuses* for the ballast pump, heater, air compressor, fore and aft winches, hoist, and rotate controls are located on the control panel. Each switch is clearly marked and must be closed before an attempt is made to operate the equipment.

Engine instruments and controls

The crane is equipped with various manufacturer's diesel-driven generator sets that are used for main and auxiliary power. Although the physical location of the controls and instruments varies, the following main diesel engine controls and instruments and the auxiliary generator set and instruments are standard equipment.

The following controls and instruments are found on the main diesel engine. Since the main diesel engine is air-started, the *starting air-inlet valve,* usually located on the operating side of the engine, is a master valve between the air reservoir and the engine. The air-start lever (Atlas Model 6EN668 engine) is used to turn the engine over by applying compressed air to the starting air inlet valve.

The fuel injection pressure is controlled by adjusting the *fuel pressure-regulating valve* handle up or down (Atlas Model 6EN668 engine). Moving the handle in an upward direction increases the pressure, while a downward movement lowers the pressure.

Both the start and stop functions of the engine are performed with a common *control lever* (Chicago Pneumatic Model 9CP engines). A button on the end of the lever is pressed to release the lever so that it may be moved to another position. The lever latches into position when the button is released.

Atlas governors on the main diesel engines are equipped with either a *speed control* handwheel or a lever. The handwheel or lever is used to set the engine speed at idle or to its rated speed. A hand lever, located on top of the governor, is used to stop the engine.

The synchronizer speed control of the Woodward Model UG-8 governor is used to change the speed of the engine the same as the Atlas governor speed control handwheel or lever. The synchronizer indicator, located directly below the synchronizer knob, indicates the number of revolutions of the knob. The speed-droop control is used to divide and balance the load automatically' between engines driving the same shaft or paralleled in an electrical system. The quantity of fuel supplied to the engine is controlled by the load-limit control. The load-limit control is also used to shut off the engine.

The Pickering Type 2600 governor supplied on the Chicago Pneumatic engine is a ball bearing, vertical, centrifugal type, mounted on the engine gear case. The governor is provided with a handwheel attached to its side. The speed is changed by increasing or decreasing the tension upon the governor spring with the handwheel.

The *engine instruments* on the engine instrument board consist of the oil pressure gage, water temperature gage, fuel pressure gage, oil temperature gage, starting air gage, and pyrometer.

The various types of diesel-driven auxiliary generator sets are battery-started. They are equipped with either a 12-volt or 24-volt battery system. An instrument board is supplied with each engine; it usually contains speed controls and various engine instruments.

The *speed controls* for the auxiliary diesels are of the centrifugal, flyball type, designed to provide constant speed under varying load conditions. A throttle knob or adjusting screw is provided for starting and idling the engine.

The *auxiliary engine instruments,* located on the engine instrument board, usually consist of an oil pressure gage, ammeter, and a water temperature gage.

OPERATOR'S CAB

The various electrical and mechanical controls for the boom hoist, main hoist, auxiliary hoist, and rotate motions of the crane are arranged in the crane operator's cab as shown earlier in this chapter.

Hoist controls

The *hoist master switch* is mounted on the control stand at the left of the operator's cab. It regulates the direction of motor rotation and the power applied to the hoist motor. Thus it controls the raising or lowering of the boom and main or auxiliary blocks. There are five notched positions for the handle on each side of the off or center position corresponding to five operating speeds. The hoist master switch also controls the operation of the magnetic electric brake mounted on an extension of the hoist motor pinion shaft.

Three identical *air clutch control valves* are connected to a common air supply header. They are mounted on the front console of the individual air clutch associated with the auxiliary, main, and boom hoist drums respectively. A hand-operated lever on each valve controls the air pressure released to the respective clutch. The clutch air system operates on 110 psi air pressure supplied through a reducing valve from the 250-psi main air pressure system. A small air tank installed in the machinery house is also connected to the system to maintain a slight reservoir or cushion to diminish air pressure fluctuation during operation.

The boom, main, and auxiliary *hoist pawl levers* are located in the cab at the operator's lower right side. Each is connected by a series of link rods and rocker levers from the operator's cab to the respective pawls at the boom, main, and auxiliary hoist drums. Each drum is equipped with a built-in ratchet to which a pawl can be engaged to hold the load on the drum when the respective clutch and mechanical brake are to be released.

The *boom hoist hand-brake lever* is mounted in the floor at the operator's right and is connected to the boom hoist drum mechanical brake by a system of link rods and rocker levers. A vertically mounted ratchet plate is engaged in operation of the lever to hold any set position.

The auxiliary and main *hoist foot-brake pedals* are mounted directly in front of the operator and are connected by a series of link rods and rocker levers to the auxiliary and main hoist drum mechanical brakes respectively. Each pedal is serrated on its forward edge to engage in operation with the dogplate mounted at the floor lever. Springs are fitted to the bottom of each pedal shank so as to engage the serrated edges of the pedals with their dogplates.

Rotate controls

The *rotate master switch* is mounted on the control stand at the right side of the operator's cab. This switch controls the speed and direction of rotation of the rotate drive motor, and thus the speed and direction of motion of the crane on its base.

The *rotate brake pedal* projects from the lower section of the control stand at the left side of the operator's cab. The *rotate brake parking push button* and associated indicating light are mounted on the control stand at the operator's left. This push button de-energizes the magnetic check valve of the brake. This releases the brake fluid trapped in the releasing cylinder and allows the brake to be set by spring action. This parks the crane in the desired position.

Miscellaneous controls

Several miscellaneous controls associated with the general operation of the hoist and rotate machinery are installed in the operator's cab. These controls include the emergency stop push button, breaker-reset

push button, diesel engine fuel-pressure control, electric governor, and radius indicator.

The *emergency stop push button* is located on the floor of the operator's cab at the base of the left control stand. Depressing this push button opens the hoist and rotate contractors on the main panel board. This cuts off power from the hoist and rotate machinery and simultaneously applies the motor brakes.

The *breaker-reset push button* is located on the control stand at the left of the operator's cab. This push button resets the hoist and rotate contractors of the main panel board after interruption of the hoisting or rotate power.

The *diesel engine fuel pressure control is* mounted at the rear to the left of the control stand in the operator's cab. This control increases or decreases fuel pressure to the main diesel fuel injectors.

A dial-type *radius indicator* is mounted on the left side of the operator's cab, just outside the cab window (see the following illustration). This indicator is actuated through linkage by motion of the boom. It serves to indicate the actual radius at which the boom is located during normal service. It also indicates maximum safe loading for the respective positions of the boom, using either the main or auxiliary hoist block.

Miscellaneous cab equipment

In addition to the controls located in the operator's cab, several items of equipment are installed for the convenience of the operator and for the operating safety of the crane. This equipment includes the air horn, signal bell, floodlight control lever, list indicators, cab heater switches, windshield wiper rheostat, and battery lantern.

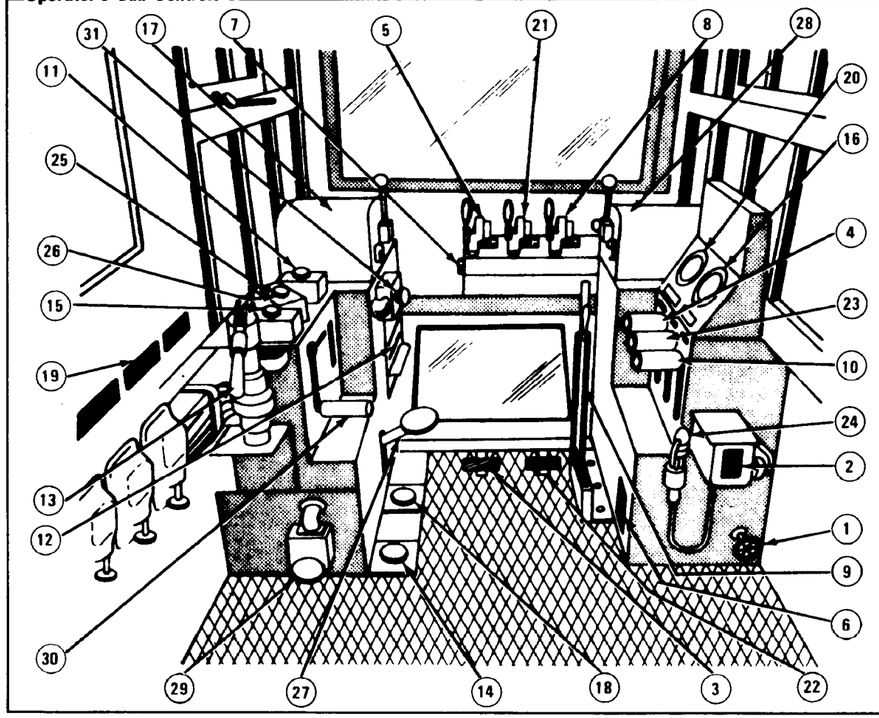
An *electric horn* installed on top of the operator's cab sounds when the floor-mounted horn push button engages the horn. The horn is actuated through an internal solenoid valve connected to a 120-VDC circuit from the machinery house lighting panel.

An 8-inch, 120-VDC *signal bell* and push button are installed in the operator's cab. These are connected in a common circuit to an identical signal bell and push button in the machinery house and forward engine room. They are arranged so that both bells will ring when either push button is operated. The *floodlight control lever* in the operator's cab is used to maneuver the flood light located on top of the operator's cab. Longitudinal transverse list *clinometers* are also installed in the operator's cab, These clinometers (shown in the following illustration) are provided to indicate to the operator the transverse heel and longitudinal trim of the crane hull when the boom is either parallel or at a right angle to the vessel's centerline.

The *cab heater switches* in the operator's cab control the operation of a 240-VDC, blower-type air heater that provides heat to the operator's cab. The windshield wiper on the front of the operator's cab operates on 120-VDC line from the machinery house lighting panel and is started and controlled by the *windshield wiper rheostat* on the left wall of the operator's cab.

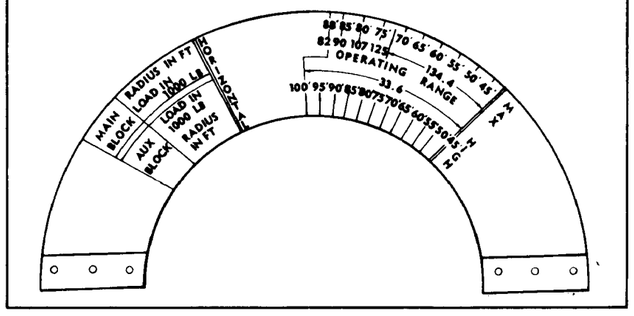
Three *battery-operated hand lanterns* are installed as part of the vessel's equipment. These units are connected to relays and will automatically light when the vessel's 120-VDC electrical circuit is interrupted. Each is equipped with a manual shutoff switch and may be removed for use as a portable lantern.

Operator's Cab Controls

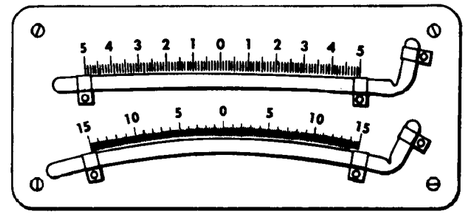


1 AIR CUTOFF VALVE
2 AIR PRESSURE INTERLOCK SWITCH
3 AUXILIARY HOIST FOOT-BRAKE PEDAL
4 AUXILIARY HOIST PAWL LEVER
5 AUXILIARY HOIST AIR CLUTCH CONTROL VALVE
6 BLOWOFF VALVE (AIR FILTER)
7 BLOWOFF VALVE
8 BOOM HOIST AIR CLUTCH CONTROL VALVE
9 BOOM HOIST HAND-BRAKE LEVER
10 BOOM HOIST PAWL LEVER
11 BREAKER RESET PUSH BUTTON
12 CAB HEATER
13 DIESEL ENGINE FUEL PRESSURE CONTROL
14 EMERGENCY STOP PUSH BUTTON
15 ENGINE ROOM-CALL PUSH BUTTON
16 HIGH-PRESSURE AIR GAGE
17 HOIST MASTER SWITCH
18 HORN PUSH BUTTON
19 LIGHTING CONTROL PANEL
20 LOW-PRESSURE AIR GAGE
21 MAIN HOIST AIR CLUTCH CONTROL VALVE
22 MAIN HOIST FOOT-BRAKE PEDAL
23 MAIN HOIST PAWL LEVER
24 RELIEF VALVE
25 ROTATE BRAKE INDICATOR LIGHT
26 ROTATE BRAKE PARKING PUSH BUTTON
27 ROTATE BRAKE PEDAL
28 ROTATE MASTER SWITCH
29 SIGNAL BELL PUSH BUTTON
30 SPUD CONTROL HANDLE
31 SPUD LIMIT SWITCH-BYPASS PUSH BUTTON

Radius Indicator



Clinometers



OIL AND WATER TANKS

FUEL OIL

Storage tank

The fuel oil storage tank is located in the vessel's hold at the starboard side of the whirler base; it holds about 1,620 gallons. The tank is fitted with a 4-inch screened gooseneck vent, a 1 1/4-inch capped return line, and a 1 1/4-inch capped discharge line, all of which extend above the deck. Near the gooseneck vent is a 1 1/2-inch, socket-type deck plug that can be removed for the filling and sounding of the tank. Tee wrenches are usually installed in nearby brackets for removal of these plugs. Any hose required for filling this tank will be obtained from the shore installation and not stored aboard the crane. The tank will never be filled completely; about 2 percent of the volume will remain empty to allow for expansion. A sounding rod, marked in feet and inches, is normally stowed in the engine room. A sounding chart and record of fills is installed near the log desk in the machinery house or engine room.

Day tank

A 150-gallon fuel oil day tank is installed on the crane overhead on the starboard side of the machinery house. This provides for direct fuel oil supply to the main and auxiliary diesel engines in normal operation. This tank is usually filled by the fuel oil pump, except in initial operation when power is not available to operate the pump.

For initial operation, the tank must be filled by hand. A drain tank, located immediately aft of the fuel oil pump, is fitted with a hand pump to pump fuel oil from that tank to the overhead day tank. The drain tank holds about 14.5 gallons. To fill the day tank, pour fuel oil into the drain tank by means of any of the funnel connections installed adjacent to the engine. This fuel oil may then be pumped by hand into the day tank. This will have to be repeated several times to ensure an adequate initial supply of fuel oil in the day tank.

After filling the tank in this manner, the auxiliary diesel generator set will be started to supply power to operate the fuel oil pump. The fuel oil pump may then be operated to complete filling the day tank.

Fill the fuel oil day tank in the following manner:

Step 1. Orient the crane with the boom forward, and temporarily secure it against rotation.

Step 2. Check to see that one end of a 20-foot length of 1 1/4-inch fuel oil hose (installed on stowage brackets on exterior starboard side of machinery house) is connected to the suction line on the fuel oil pump and that the other end is connected to the discharge line on the main tank.

Step 3. Check to see that one end of the other 20-foot length of 1 1/4-inch fuel oil hose is connected to the overflow line from the fuel oil day tank and the other end is connected to the return line on main fuel oil tank.

Step 4. Open the valve at the suction side of the pump and into the overflow line.

Step 5. Start the pump and operate until the sight gage in the overflow line shows that the tank is full; then shut down the pump.

Step 6. Allow a short time for oil in the hoses to drain back to the main fuel oil tank; then close both valves in the pump suction line and overflow line.

Step 7. Disconnect the hoses at the main fuel oil tank connections and stow the free ends in brackets in the machinery house. Recap the fuel oil tank connection.

Step 8. Open the valves in the supply lines to the engine to supply fuel oil to either engine.

Since the supply of fuel oil in the day tank is the immediate running supply for both the main and auxiliary diesel engines, this tank must be kept filled at all times. Loss of day tank fuel oil may create air bubbles in the engine injection system, with consequent difficulty in further operation until the situation is corrected. Since power is required to run the fuel oil pump as supplied by the diesel generators, loss of day tank fuel oil will obviously require refilling that tank by hand.

Drain tank

This drain tank is provided to catch the fuel oil drippings from the engines in normal operation. The fuel oil return from the pressure pumps on the engines is piped directly to the day tank. The drain tank should be emptied occasionally by operating the hand pump. The sounding rod stored in the machinery house provides a means of determining the contents of the tank. Experience will indicate the general frequency of this operation.

LUBRICATING OIL

A 60-gallon lubricating oil storage tank is installed overhead in the machinery house to provide makeup or new oil for engine crankcases and other general lubrication. This tank must be tilled at the 2-inch filling connection that extends above the machinery house roof. The lubricating oil level can be determined by a sight gage glass installed on the end of the tank. A valved supply line from the tank is conveniently located on the starboard side of the house near the auxiliary diesel generator set for general lubricating oil service. Additional oil can be placed in the respective diesel engines by transferring oil from the supply line to the plug or breather opening in the side of the engine. A four-quart measuring can with a funnel spout is provided with the vessel's equipment for this purpose.

FRESH WATER

Two types of freshwater tanks are provided for the crane: the main hull and the service tanks.

Main hull freshwater tank

The main hull freshwater tank is located in the vessel's hold at the port side of the crane whirler base; it holds about 600 gallons. This tank has a screened gooseneck vent and a 1 1/4-inch capped discharge line, both of which extend above the deck. A 1 1/2-inch socket-type deck plug that can be removed with a tee wrench to fill the tank is located just forward of the discharge line. Hose required to fill this tank will be obtained from the shore installation.

Freshwater service tank

The freshwater service tank is installed overhead in the machinery house on the port side. Its purpose is to provide a standby of makeup water for the radiator cm-ding system of the main and auxiliary diesel engines. The freshwater service tank has a 60-gallon capacity. This tank does not have to be filled for initial engine operation, since the radiator systems of the engines may be filled by hand. The auxiliary diesel engine provides power to run the freshwater pump. This pump fills the service tank from the main hull freshwater tank, after which the main engine radiator can be filled.

To fill the service tank by means of the freshwater pump, proceed as follows:

Step 1. Orient the crane with the boom forward, and secure temporarily.

Step 2. Check to ensure that one end of the 20-foot length of 1 1/4-inch freshwater hose is connected to the suction side of the freshwater pump. This hose is stowed on brackets on the port exterior side of the machinery house.

Step 3. Connect the other end of the hose to the discharge connection of the main hull freshwater tank.

Step 4. Ensure that the valves in the supply lines from the service tank to the engines are closed.

Step 5. Open the valve at the suction side of the pump.

Step 6. Start the pump and operate until the sight gage glass on the tank indicates full; then stop the pump.

Step 7. Allow a short period for water in the hose to drain back to the hull tank; then close the valve in the pump suction line.

Step 8. Disconnect the hose when the tank is full and stow the free end in the stowage brackets. Recap the water tank discharge connection. The supply lines from the freshwater service tank terminate in valve connections and flexible hoses just above the filling points for the main and auxiliary engines.

Step 9. After filling the tank, open the valves immediately below the tank to supply water to the terminal valves. Makeup water is then available to fill the radiators.

CRANE OPERATION PROCEDURES

LOAD HOOKS

The crane is equipped with a main and an auxiliary load hook for hoisting and lowering of loads.

Hoisting

Hoisting consists of raising a load vertically on either the auxiliary or main load hook. This is done by applying power to the respective drum that, through the cable and sheave block arrangement, lifts the hook. After consulting the operational load chart, proceed with the hoisting as follows.

Place the master switch in the neutral position. Operate the clutch control to engage the clutch on the drum to be used for hoisting, and, at the same time, release the foot-brake pedal and increase the engine speed to prevent stalling. To raise the hook, pull the master switch back to the desired position. To stop movement when the load or tackle has reached the desired height, place the master switch in the neutral position, and, at the same time, release the drum clutch, depress and lock the foot-brake pedal, and throttle the engine to about half speed. If the load is to be held in the raised position for an extended time, engage the dog pawl into its drum ratchet.

Procedures for operating the whip or main load hook are identical. Each hook has its own hoisting drum with separate controls. On heavy lifts, inch the load slightly, stop and test the brakes to see if they are functioning properly, and then complete the hoisting operation. Do not lift loads heavier than those specified at the selected operating radius.

During hoisting operations, the operator will strive to improve coordination in movement of controls for smoothest operation possible. This practice will minimize strain on the equipment and prevent rough and jerky operation.

Lowering

This operation consists of lowering the auxiliary or main load hook to the desired position. Lowering is performed by the weight of the empty hook blocks or the load unwinding the cable from its respective drum. It is controlled by the braking action on the drums. To lower the loads, proceed as follows.

With the engine throttle at approximately half speed and the selected clutch control in its neutral position, release the foot-brake pedal or motor dynamic brake controller, and control lowering by brake resistance. When the load is partially lowered and left hanging for an extended time, engage the dog pawl into its drum ratchet.

LOAD SWINGS

One of the main difficulties for an inexperienced crane operator is controlling the tendency of a load to swing while transporting. Unusual load swings are caused by sudden stops and starts of the swinger gear, but sometimes are the result of high winds and heavy seas. A slow, deliberate operation of the swinger control and smooth brake operation will help reduce load swings to a minimum. If a load should develop an undesirable swing, it can be neutralized by quickly moving the boom tip directly over the center of the load and stopping the swinger gear at that point. With diligent practice, the operator will soon become adept at controlling load swings.

HEAVY LIFTS

Rotate control

At times the crane will be lifting at almost capacity tonnage, and during such operations there may be a great deal of rotating.

The operator must be very careful when swinging the load, and, unless he is experienced and accustomed to the crane, he must make the swing very slowly. The load must have tag lines attached to prevent it from swinging. Remember that the barge will list in the direction of the lift. When transporting the load, the barge will be pulled slowly up this incline until the crane is level. As the crane begins to list in the opposite direction, the load will travel faster because of gravity. An experienced operator will compensate for this condition by the proper use of the controls. Stress on the legs of slings varies according to the angle of the sling and load. When making heavy lifts with a sling, it is advisable during normal operations to have an angle of 60° or more at the point where the sling joins the load.

Stress gage

The use of a stress gage enables the crane operator to lift loads within the safe limits for which the crane is designed. Without the use of this gage, the load may exceed the maximum capacity, serious damage may result, and the lives of personnel may be endangered. The stress gage comes as a self-contained unit with hose, reservoir diaphragm, gage, clamps, and instructions for installation. It is loaded and sealed with the proper amount of fluid when manufactured and, after installation, can be used with only minor adjustments.

> *NOTE:* For information on trouble-shooting, maintenance, and reeving the hoist and lift blocks, refer to Chapters 9 and 10.